Reducing the Risk of Hospitalization for Nursing Home Residents: Effects and Facility Variation From OPTIMISTIC

Justin Blackburn, Timothy E. Stump, Jennifer L. Carnahan, Susan E. Hickman, Wanzhu Tu, Nicole R. Fowler, Kathleen T. Unroe

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Abstract

Objectives: The Optimizing Patient Transfers, Impacting Medical Quality, and Improving Symptoms: Transforming Institutional Care (OPTIMISTIC) project led to significant decreases in potentially avoidable hospitalizations of long-stay nursing facility residents in external evaluation. The purpose of this study was to quantify hospitalization risk from the start of the project and describe the heterogeneity of the enrolled facilities in order to better understand the context for successful implementation.

Design: Pre-post analysis design of a prospective intervention within a single group.

Setting and Participants: 4,320 residents in the 19 facilities were included from admission until time to the first hospitalization.

Measures: Data were extracted from Minimum Data Set assessments and linked with facility-level covariates from the LTCFocus.org data set. Kaplan-Meier and Cox proportional hazards regression were used to assess risk of hospitalization during the pre-intervention period (2011–2012), a "ramp-up" period (2013–2014), and intervention period (2015–2016).

Results: The cohort consisted of 4,230 long-stay nursing facility residents. Compared to the pre-intervention period, residents during the intervention period had an increased probability of having no hospitalizations within 1 year, increasing from 0.51 to 0.57, which was statistically significant ($p<0.001$). In adjusted Cox models, the risk of hospitalization was lower in the ramp-up period compared to the pre-period (Hazard ratio [HR] 0.85, 95% confidence interval [CI] 0.75—0.95) and decreased further during the intervention period (HR 0.74, 95% CI 0.65—0.84).

Conclusions and Implications: As part of a large multi-site demonstration project, OPTIMISTIC has successfully reduced hospitalizations. However, this study highlights the magnitude and extent to which results differ across facilities. Implementing the OPTIMISTIC

program was associated with a 16% risk reduction after the first 18 months and continued to a final risk reduction of 26% after 5 and a half years. Although this model of care reduces hospitalizations overall, facility variation should be expected.

Introduction

Long-term nursing facility residents (hereafter called residents) are at high risk of experiencing potentially avoidable hospitalizations.[1-6] As many as 60% of resident hospitalizations may be potentially avoidable, especially those related to five conditions: pneumonia, congestive heart failure, urinary tract infections, dehydration, and chronic obstructive pulmonary disease/asthma.[2] Additionally, the likelihood of having a potentially avoidable hospitalization is associated with resident sociodemographics, facility characteristics and substandard care practices, such as the type and level of staffing, their access to ancillary services, and use of hospice.[1,7-9]

In response to the high number of potentially avoidable hospitalizations of residents, the Centers for Medicare and Medicaid Services (CMS) Innovations Center funded seven projects under the National Initiative to Reduce Avoidable Hospitalizations Among Nursing Facility Residents. Researchers and clinicians at [institution redacted] developed the Optimizing Patient Transfers, Impacting Medical Quality, and Improving Symptoms: Transforming Institutional Care (OPTIMISTIC) Model, which was one of the seven sites funded under this national clinical demonstration project.[10] In order to participate in the project, CMS required facilities to complete a readiness review process as well as meet inclusion criteria which included having a minimum 3-star quality rating on the CMS Nursing Home Compare. In total, OPTIMISTIC recruited 19 facilities in Central Indiana to participate.

In brief, the OPTIMISTIC program employs full-time registered nurses to work with staff at each facility to assess and address changes in resident condition and quality improvement efforts. Additionally, OPTIMISTIC nurse practitioners provide in-person evaluations and management of residents with acute condition changes. Evidence-based processes implemented

under OPTIMISTIC include coordination of care through collaborative care reviews, Respecting Choices Advanced Steps advance care planning facilitation, and the use of tools from Interventions to Reduce Acute Care Transfers.[3,11,12]

The CMS evaluation of the national demonstration project found an overall reduction in resident hospitalizations without increasing mortality across all participating sites.[13,14] However, variation was noted and OPTIMISTIC had a larger reduction in potentially avoidable hospitalizations relative to other sites.[10,14] The goal of these analyses was to further explore the initial findings and quantify the timing and facility-level variation in the reduction of hospitalization risk among facilities participating in OPTIMISTIC.

Methods

Full details of the OPTIMISTIC program, including facility and resident eligibility criteria are described elsewhere.[10] Nineteen facilities in Indiana were enrolled in the OPTIMISTIC program in October 2012. Per CMS, the focus of OPTIMISTIC was long-stay residents (>100 days in a facility) or those with no documented discharge plans on the Minimum Data Set (MDS). This analysis focused on the time-to-first hospitalization among eligible residents to quantify the risk of hospitalization during OPTIMISTIC implementation. For these analyses, eligible residents and their time-to-first hospitalization were identified from the MDS and divided into three 18-month observation periods: pre-OPTIMISTIC (January 1, 2011 - June 30, 2012); OPTIMISTIC ramp-up (January 1, 2013 - June 30, 2014); and full OPTIMISTIC intervention (January 1, 2015 - June 30, 2016). These observation periods corresponded to the time before any OPTIMISTIC elements were implemented, when OPTIMISTIC staff were present in facilities but their novel roles were still being defined and integrated into care

practices, and when the full OPTIMISTIC model was in place. A second phase of the CMS national demonstration project began in October 2016 for all seven sites, including OPTIMISTIC, wherein additional facilities were enrolled. Consequently, 18-month observation periods were selected to ensure homogenous non-overlapping intervals anchored by the period of full implementation of OPTIMISTIC from January 1, 2015 through June 30, 2016. Facility-level covariate information was obtained from LTCFocus.org data including percentage of residents with primary payer of Medicare, facility type, and average direct care hours per patient provided by registered nurses, licensed practical nurses, certified nursing assistants, percentage female, percentage white, average activities of daily living score, total beds, percentage with severe cognitive impairment (as measured by the Cognitive Function Scale), and average Acuity Index of the facility. Kaplan-Meier curves estimating the probability of a resident being hospitalization-free from time of eligibility were calculated overall and separately for each facility. Resident observations were censored if they left the facility, died, or had not been hospitalized by the end of observation period. A log-rank test was used to compare the hospital-free time distribution among the three time periods. Mixed-effects Cox proportional hazards regression was used to estimate hazard ratios (HRs) and associated 95% confidence intervals (CIs) of hospitalization risk, adjusted for covariates; a random intercept was included in the model to accounting for correlations among residents residing the same facility. Statistical significance was assumed $\alpha = .05$. Analyses were performed using R software (R Foundation for Statistical Computing, Vienna, Austria). The OPTIMISTIC demonstration project is approved by the [institution redacted] Institutional Review Board.

Results

The distribution of eligible residents (N=4,320) remained constant over time and facility, with n=1,434 in the pre-intervention period, 1,426 in the ramp-up period, and 1,460 in the intervention period. Overall, facility #18 had the largest proportion of residents with 8.1%, whereas facility #14 had the smallest with 2.5%. Kaplan-Meier curves are shown for the overall sample (Figure 1). A statistically significant difference in time-to-hospitalization was observed across all three time periods (log-rank $p<0.001$); pairwise comparisons further revealed statistically significant differences across each time period (pre-intervention vs. ramp-up $p=0.013$; pre-intervention vs. intervention $p<0.001$). The estimated probability of remaining hospitalization-free at 12 months was 0.51 during the pre-intervention, 0.57 during ramp-up, and 0.59 during the intervention. Kaplan-Meier estimates by facility (Figure 2) revealed that six of the nineteen facilities (32%) exhibited statistically significant period effects indicating the risk of hospitalization differed over time for these facilities. Two facilities demonstrated a large decreased risk of hospitalization during the intervention (facilities #6 and #8). Another facility demonstrated an increased risk of hospitalization during the intervention (facility #3). The other facilities showed a moderately lower risk of hospitalization during the intervention period (facilities #2, #10, and #12). Additionally, although log-rank tests were not statistically significant at conventional levels, the survival curves for an additional 6 facilities displayed separation indicating lower hospitalization risk in the full OPTIMISTIC intervention period compared to other periods (facilities #4, #7, #14, #16, #17, and #18). The Cox mixed effects proportional hazards model (Table 1) showed that compared to the pre-intervention period, residents in the ramp-up period had a lower risk of hospitalization (HR 0.84, 95% CI 0.75—0.95) and in the intervention period (HR 0.74, 95% CI 0.65—0.84). Facility-level variance in unadjusted models was 0.09 and was reduced to approximately 0.01 with the addition of the

facility-level baseline covariates. Inclusion of covariates did not change estimates for intervention period effects.

Discussion

We estimated a 16% decrease in the risk of first all-cause hospitalization among residents in OPTIMISTIC facilities after the first 18 months of the intervention; a risk that continued to decline to a 26% reduction after 5 and a half years. There was notable heterogeneity in the effect across facilities—although pooled estimates show OPTIMISTIC facilities collectively lowered hospitalization risk over time, statistical differences across periods were not seen in all participating facilities. Facility-level covariates decreased model variance and warrant further investigation.

Facilities nationwide are changing the delivery of care to residents in response to state and federal policies to incentivize value and quality, using elements similar to the OPTIMISTIC clinical model.[15] We observed reductions in hospitalization risk consistent with the overall initiative's evaluation.[14] Furthermore, our 26% risk reduction was consistent with another site's 30% reduction.[16] The overall initiative's qualitative findings hypothesized that heterogeneity in the effects across states and facilities was attributable to variation in facility resource commitment and implementation timelines.[14] We provide evidence in support of this hypothesis, such that timeliness and magnitude of effects differed by facility.

Linking specific characteristics of implementation, such as the facility's leadership commitment and staff type and turnover, were beyond the scope of these analyses but could potentially further explain the effect heterogeneity. However, some salient examples derived from monthly calls with facilities and project operations notes warrant mention. Although the

full OPTIMISTIC model was approved by all facilities, those with more engagement and enthusiasm from the executive director, director of nursing, or parent corporation tended to experience greater reductions in hospitalization risk. Such was the case in facilities #8, #6, #10. For example, the medical director of facility #6 demonstrated this enthusiasm by actively participating in OPTIMISTIC-led in-service activities, showing support and providing perspective on how communication practices could be improved. In other cases, facilities were not enthusiastic about integrating the OPTIMISTIC nurse into the existing staff. For example, facility #3 did not fully integrate the OPTIMISTIC nurse into the broader facility communication channels, and often expressed "working in parallel" with the facility rather than in conjunction with. A deeper understanding of successful implementation of programs like OPTIMISTIC designed to reduce hospitalizations is still needed, but the Indiana experience highlights engagement and enthusiasm from leadership accelerates change.

Our analyses did not estimate the direct effect attributable to the OPTIMISTIC intervention, as there was no true comparison group. Rather, we sought to characterize differences in hospitalization risk over time after implementation of OPTIMISTIC. Limiting to the first hospitalization per resident may overestimate the effect on overall transfers if subsequent transfers were numerous. In some facilities, the number of hospitalizations was low and created instability in the facility-level Kaplan-Meier curves and could have resulted in a lack of adequate statistical power for the log-rank test. Despite these limitations, our analyses enhance the current understanding of hospitalization risk during implementation of a novel care model as well describing differences in facility-level response.

Conclusions and Implications

Our results indicate that nursing facilities with varying characteristics can successfully adopt the OPTIMISTIC model and sustainably improve the risk of hospitalizations within 18 months. Our granular analyses are consistent with findings from the overall evaluation of the national demonstration project, while revealing facility-level variation in the magnitude and timing of effect.[13,14] For facilities seeking to implement quality improvement efforts and/or new care models aimed at reducing hospitalizations, the OPTIMISTIC model shows promise.

Conflicts of Interest

[Redacted author] is CEO and Founder of [redacted company name], a program to train nurses to reduce nursing home hospital transfers. No other authors have potential conflicts of interest to declare.

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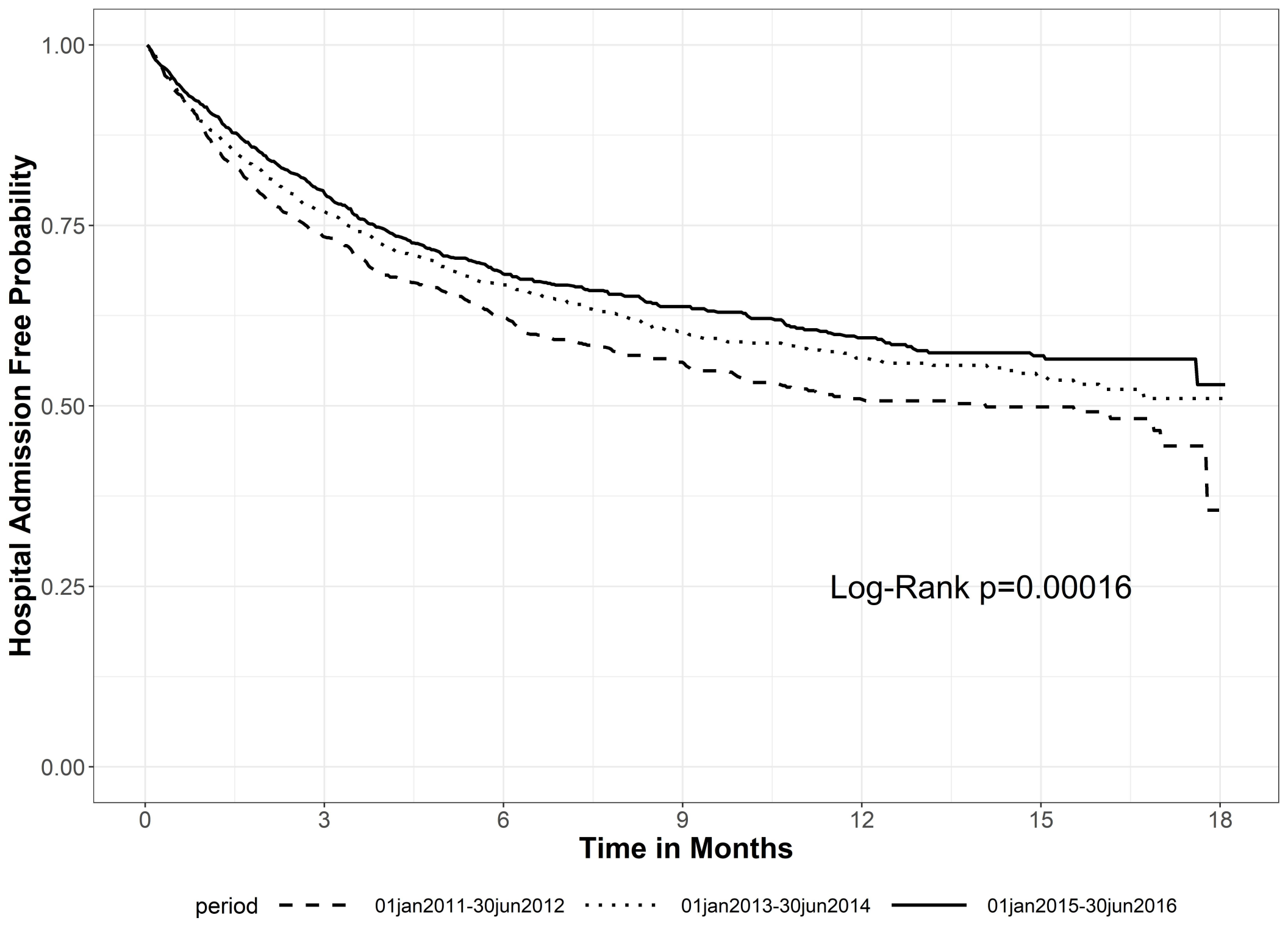
227 Figure 1 Kaplan-Meier curves for the total sample by time period (N = 4,320)

228 Figure 2 Kaplan-Meier curves for each OPTIMISTIC nursing home facility


1.00
0.75
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Hospital Admission Free Probability
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Time in Months
Log-Rank p=0.00016
period
01jan2011-30jun2012
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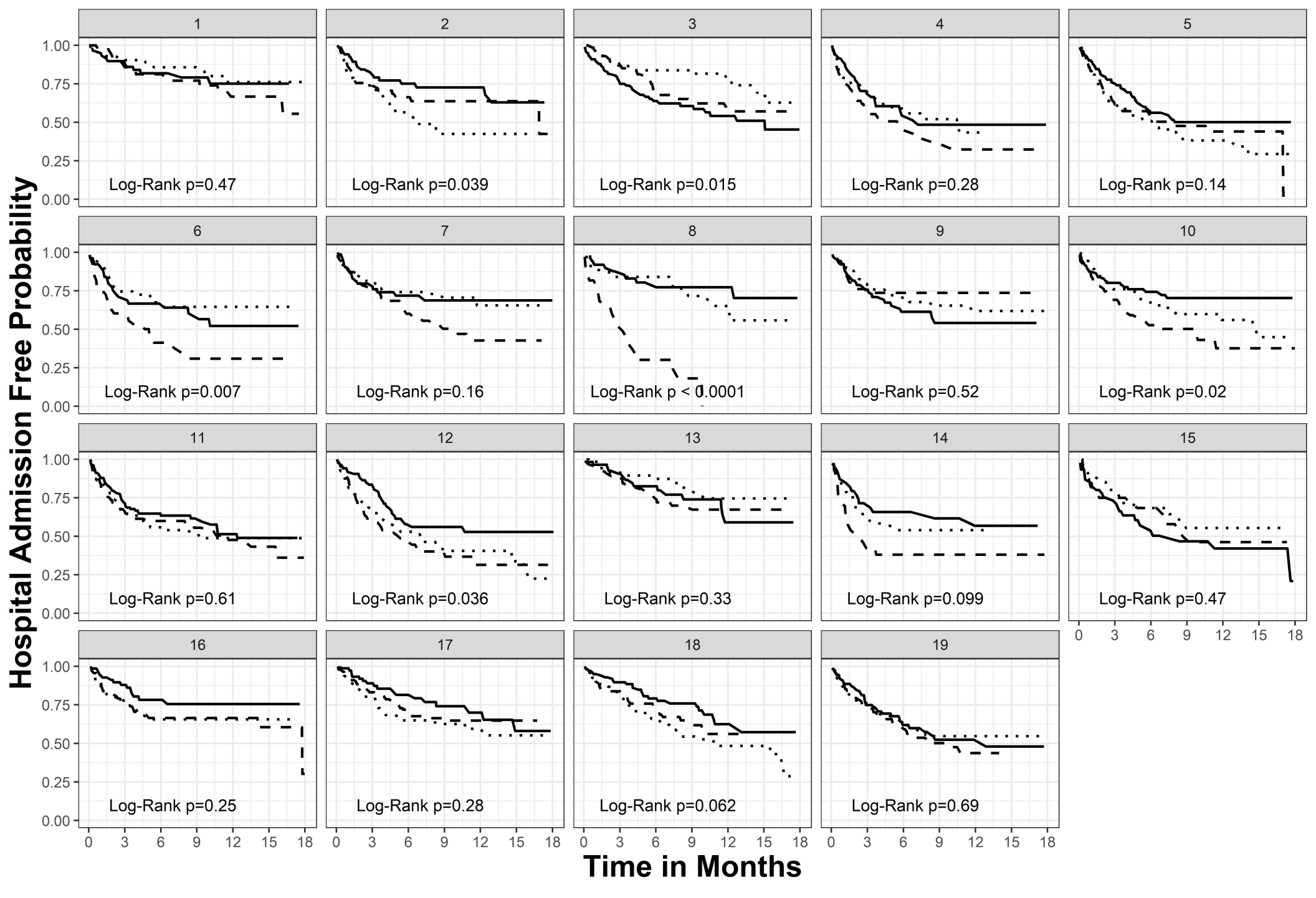
01jan2015-30jun2016


1
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Log-Rank p=0.47
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Log-Rank p=0.16
Log-Rank p < 0.0001
Log-Rank p=0.52
Log-Rank p=0.02
Log-Rank p=0.61
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Log-Rank p=0.33
Log-Rank p=0.099
Log-Rank p=0.47
Log-Rank p=0.25
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Log-Rank p=0.062
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Hospital Admission Free Probability
0.00
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0 3 6 9 12 15 18
Time in Months
period
01jan2011-30jun2012
01jan2013-30jun2014
01jan2015-30jun2016

Table 1. Frequency distribution and corresponding hazard ratios with 95% confidence intervals for each characteristic.

	Residents N=4,320 n (%) or mean (SD)	Hazard Ratio	95% Confidence Interval
OPTIMISTIC Study Periods			
Pre-OPTIMISTIC Period (January 1, 2011 - June 30, 2012)	1,434 (33.2%)	Reference	
OPTIMISTIC Ramp-up (January 1, 2013 - June 30, 2014)	1,426 (33.0%)	0.845	(0.748-0.954)
OPTIMISTIC Intervention (January 1, 2015 - June 30, 2016)	1,460 (33.8%)	0.739	(0.653-0.836)
Profit status of facilities			
Not-for-profit	3,200 (74.1%)	Reference	
For-profit facilities	1,120 (25.9%)	1.212	(0.984-1.494)
Facility percentage of residents with Medicare as primary payer	19.2 (7.4)	1.023	(1.001-1.046)
Registered nurse hours per resident per day (average)	0.4 (0.2)	1.947	(1.403-2.700)
Licensed practical nurse hours per resident per day (average)	1.0 (0.2)	0.863	(0.552-1.349)
Certified nursing assistant hours per resident per day (average)	2.0 (0.4)	0.994	(0.722-1.369)
Percentage female in facility	63.8 (7.2)	0.993	(0.980, 1.007)
Percentage white in the facility	77.2 (20.5)	0.998	(0.993, 1.003)
Average activities of daily living score in the facility	18.1 (1.5)	0.996	(0.912, 1.088)
Total beds in the facility	154.2 (29.1)	1.001	(0.998, 1.004)
Average percentage of severe cognitive impairment on the Cognitive Function Scale in the facility	6.9 (7.4)	1.001	(0.988, 1.014)
Average Acuity Index of the facility	10.8 (3.7)	0.989	(0.973, 1.007)

Note: hazard ratios estimated from multi-level Cox regression accounting for nesting of residents within facilities and adjusted for all other characteristics. Source: author's analysis of OPTIMISTIC data along with facility-level characteristics from LTCFocus (www.ltcfocus.org).